The Advent of Blockchain Technology in Organic Food Value Chain

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Abstract

Blockchain Technology is an emerging concept gaining popularity in digital financial transactions, discarding intermediaries on a highly secure platform. This chapter examinesthe influence of blockchain technology in Organic food value chain, perceived the existing structure and exposure and outlined the challenges and potential with a critical view over the span of this technology. How the work can be made more efficient and productive using this technology is the main inspiration of this chapter. Our finding indicates a secure, transparent and promising technology towards the flow of a smooth organic food value chain with ongoing initiatives in various agricultural and processed organic food products. How the data can be well stored and used using this magical technology is a great experience for researchers, but many challenges and barriers exists, which obstruct its acceptance among farmer and other elements of food chain. The barrier involves technical aspects, lack of talent, energy consumption, standardization, Govt. support and regulatory framework. Coming future will surely perceive remarkable out-turn in agricultural sector by incorporating this technology in a genuine manner.

Keywords: *Blockchain Technology, Organic food, Value Chain.*

1. Introduction

To improve sustainability and productivity of Organic food sector it's highly essential to use the data and information appropriately. The efficiency and effectiveness of value chaindepends on a well-suited collection, storage and analysis of data. Up-to-date information can be readily available to the organic farming communities and agricultural practitioners for the better farming decisions (Kaddu and Haumba, 2016). Crop scouting and machinery guidance can be supervised through Global Positioning System (GPS), crop management can also be better handled by remotely sensed data on soil state (Yousefi and Razdari,2015), Cost of information has highly reduced by the use of internet through mobile phones that can promote farmers to access the markets and financial services (Kaskeetal.,2018).

Collection and processing of data through information and communication technology (ICT) cannot avert biasness as the individual operating data manipulate it as per their own interest. For example in an organization stakeholder's decision making criteria is highly influenced by the organization itself to which they belongs (Collier et al., 2014).The most constructive way to eliminate such biasness is making data manipulation very hard or impossible by decentralizing the management of data to a number of individuals.

A blockchain is an information recording system in a way which makes it difficult or impossible to cheat, change or hack the system. A blockchain is a digital ledger that is distributed and duplicated across the entire network of information system on the blockchain. This ledger is a collective management by all the participating agents through a peer-to-peer network. A number of transactions is contained by each block, and in the blockchain as a newtransaction occurs, every time that transaction record is added to each participant's ledger. This multiple participant's managed decentralized database is also known as Distributed Ledger Technology (DLT). Thus blockchain can be called as transformative ICT tool that have the power to revolutionize the data collection and usage in organic agriculture sector.

2.Research Objectives

Following are the research objectives of this chapter:

1.To study the blockchain technology in Organic food value chain, and to examine theapplicability of blockchain in the flow of an organic agricultural food value chain.

2. To study the impact of block chain technology in making food value chain more efficient,agile and optimized.

3. To consider the possible limitations of the technology too so that food value chain can beclearly understood with the incorporation of blockchain technology.

3. Blockchain in Organic agriculture and organic food Value Chain

The organic food value chain is highly distributed and multi actor based activity involves numerous actors such as farmers, distributors, wholesaler, retailer, shipping companies, groceries and others. While the blockchain technology has gained successful outcome in various organizations, crypto currencies and other entities and proved its functionality where in the distribution of some resources various actors get involved (Manski 2017). Two highly influential and consistent areas are organic agriculture and organic food value chain (Tripoli and Schmidhuber 2018). Many research studies gave evidence of use of blockchain applications in supply chain management soon after the appearance of technology (Tribis, El Bouchti and Bouayad 2018). An expected growth rate of blockchian in supply chain related activities is 87% and increase from $45 million in 2018 to $3,314.6 million by 2023 (Chang, Iakovou and Shi 2019). Many successful examples are there who incorporated applications ofblockchain management in their agriculture and agricultural food supply chain. Agri Digital Ltd. and Louis Dreyfus Co. are few names of technology users who have used cloud based technology for their transactions and created a benchmark with bombshell outcomes. As per Louis Dreyfus Co.(world's biggest foodstuffs traders) automatic matching of data in real time eliminates duplication and manual checks, processing of documents has reduced to a fifth of time. In the food value chain network the information captured during every transaction is validated by the actors of the chain, creating a consensus among each and everyparticipant of the chain. After the validation of every block in the chain of transactions it is added as a permanent record of entire process. Few relevant information that can be recorded to the blockchain , for organic food value chain is described below related to each stage:

1. **Input provider:** Records information about the crops, inputs used in the organic cultivation, transactions with the farmer/producer etc.

2. **Producer:** Information about the farm and practices of farming recorded. Additional information about weather conditions, cultivation process, crop management and animalwelfare can be recorded.

3. **Processing:** Information about the methods of processing, factory, batch no.etc. Financial transactions with distributers and producers are also recorded.

4. **Distribution:** Storage conditions (Humidity, temp.etc), shipping details, in transit time at every transport method, trajectories followed etc. Transactions between distributers and retailers are recorded in block chain.

5. **Retailer:** Detailed Information about quality, quantity, expiration dates, storage conditionsand time spent in the store of each food item are listed on the block chain.

6. **Consumer:** Consumer can scan the QR code of product using mobile phone connected to internet to see the detailed information of the product from the provider (retailer) to producer.

The below figure is a simplified illustration of organic food value chain system and its main phases and various actors of the chain. Exchange of goods is a very complex and very less transparent process which involves very high risks between seller and buyer during value exchange. These transactions are prone to frauds and malpractices, intermediaries also increase the overall transfer cost (Lierow, Herzog and Oest 2017). As per the estimation overall operating cost of value chain makes up two third of final cost of products. Thus there is a scope for optimization of value chain by effectively reducing the operating cost hence to reduce the final cost of goods.

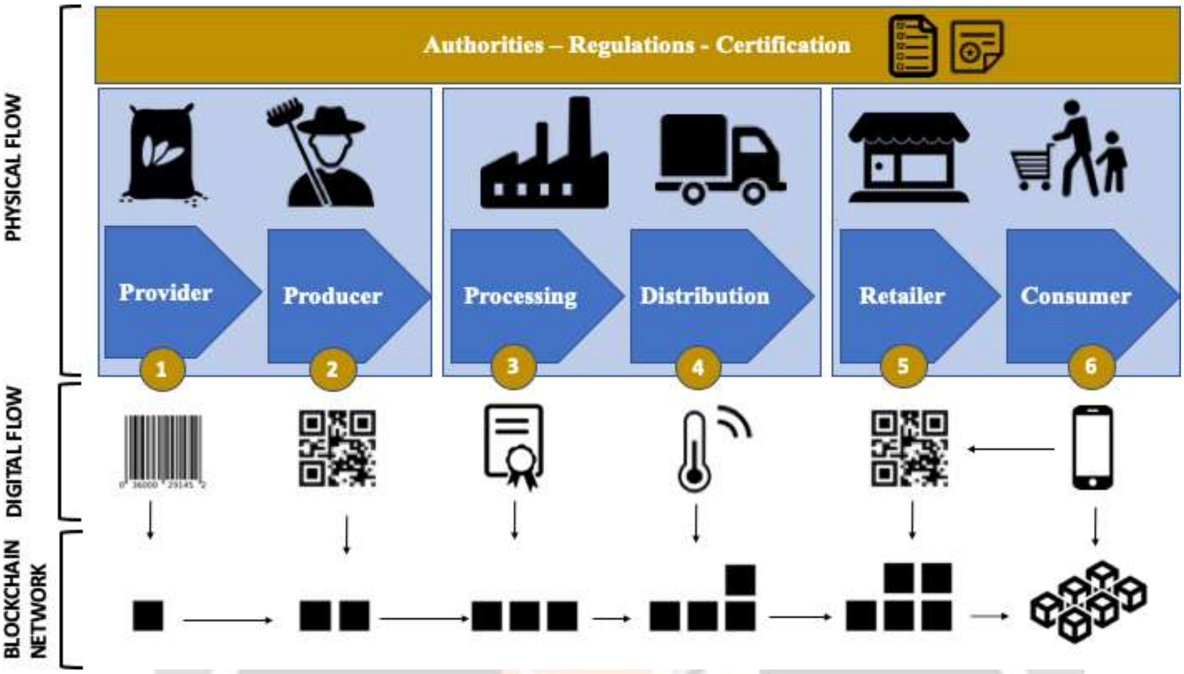

Figure: A simplified food supply chain system.

Source: Kamilaris, Andreas & Fonts, Agusti & Prenafeta Boldú, Francesc. (2019). The Rise of Blockchain Technology in Agriculture and Food Supply Chains.

4. Agile Value Chain

Traditional way to manage data was centralized which was prone to data distortion, inaccurate data, misuse of data and cyber-attacks as well. Decision maker manipulates data as per their interest but the modern technique block chain technology stores the information and data that various actors generate in the entire value added process. From seed to sale of the final product all the information is recorded accurately and transparently. Proposal and implementation of various other smart farming, storage and supply models are also based on the joint application of block chain technology. Information flow in the organic food value chain related to products from farm to fork can be accessed through simple smart mobile phones. With the use of this smart technology competency, responsiveness and quickness can be incorporated in the value chain hence making it more agile, optimized and proficient.

5. Optimization of Value chain and Value Stream Mapping

We already discussed in the previous section of our chapter that operating cost can be reduced by using block chain technology. As the information is precisely recorded, data stored by every agent of the value chain can be supervised and there is a huge scope to reduce the operating cost hence the value chain can be optimised in an efficient manner. When we incorporate a very healthy tool of value chain management that is value stream mapping then it takes us to another dimension of optimisation of resources. By the use of blockchain technology various waste management initiatives can be taken at different stages of value chain. A very good example is of plastic bank (Plastic Bank 2019), a global venture of Canada for developing countries to lessen plastic waste and recycle them. This Initiative connects the people through blockchain and rewards them through digital tokens. People can get phone charging units or food in any store using plastic bank app (Steenmans and Taylor 2018).

Talking from inputs to finished products each stage can be effectively supervised by the accurate data and information storage system that can keep a precise view over the waste reduction. Thus Value Stream mapping can be productively done by incorporating this technology. Blockchain allows to collect a detailed information which can be continually update using Bluetooth , Wi-Fi or simple internet on quantities of each kind of waste that waste managers collect. Blockchain records every action taken and overall value chain. To improve sorting of waste produced and recycling along the food chain other commercial solutions include Recereum (Recereum 2017) and Swachhcoin (Swachhcoin 2018).

6. LIMITATIONS

Blockchain technology provides a reliable and secure way of managing and storing data that assures ease to the development and innovations for efficient and agile organic food value chain. It can optimise the resources and the value addition by reducing operating cost which will benefit all the actors of the chain including the farmers and the ultimate consumer as well. Despite boundless prospective advantages, certain limitations are also there in applying blockchain technology for organic agriculture and food sector. First further research is required for the motivation to the transacting parties to provide precise and accurate information to the blockchain ledger. The information related to farming process is very dispersed and possessed by individual farmers. Integration and collection of data related to farm and farming process can be easily done with large farm holders which is not easy for small farmers. Thus future research should try to anticipate the problems on producer part. Second a proper regulatory framework is required for the technology to meet the legacy system. For the successful implementation of technology it should be plugged in with existing legacy system and database like ERP (Enterprise Resource Planning), manufacturing execution systems and warehouse management System which are already standardized. As building a new infrastructure for block chain will be very time consuming.

Third obtaining the information and data to a blockchain can be very costly, that is the strongest barrier in the adoption of this technology. Fourth handling and storage of data requires technical knowledge which is lacking for this developing sector (Organic food sector). To hire separate persons at different levels is an impossible process. Thus further research is required for the adoption and execution of blockchain technology for developing economies.

7. Conclusion

This chapter demonstrates the successful implementation of this technology in many projects, aiming to create a trusted and proven abode to build a sustainable and transparent food production and supply by efficiently integrating key actors in the value chain. With the solution of issues and challenges, the organic food sector can be taken to another dimension. Govt. should come up to encourage digitalization of public administration. For the prospective benefits of the technology govt. should invest more in training and education as well as in innovation and research to reduce the barriers of use.

From the policy prospective, lot of productive work is required, such as growing of blockchain-minded system should be encouraged in agri food chains, optimizing the competitiveness, as a part of general goals the technology should be supported, ensuring the sustainability of organic food value chain as well as promoting a clear regulatory framework for the proper implementation of blockchain technology.

Summing up, towards an efficient and transparent organic food value chain, blockchain is a promising technology, but many challenges and barriers are there in its avenues, that obstruct its wider popularity among farmers and organic food value chain system. The coming time will reveal if and how these barriers could be addressed by private attempts and governmental efforts, in order to establish this technology as a reliable, secure and transparent way toensure organic food safety, integrity and sustainability.

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